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A GUIDE TO THE USE
OF
THE LARYNGOSCOPE

BY THE SAME AUTHOR.

A TREATISE ON VOCAL PHYSIOLOGY AND HYGIENE, with special reference to the Cultivation and Preservation of the Voice. Second Edition, with Engravings, crown 8vo, 6s. 6d.

A GUIDE TO THE USE

OF

THE LARYNGOSCOPE

IN GENERAL PRACTICE

BY
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PHYSICIAN TO THE MUNICIPAL THROAT AND EAR INFIRMARY; FORMERLY *CHEF-DE-CLINIQUE*
AT THE HOSPITAL FOR DISEASES OF THE THROAT; ETC.

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1881

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PREFACE.

From many cases of diseases of the larynx which have come under my notice, I have had an opportunity of observing that the laryngoscope is still but little used in the ordinary routine of medical practice.

And it appears to me that existing separate works on the instrument, notwithstanding their great literary value, are so elaborate as to induce an idea in the student that this really simple aid to diagnosis and treatment is complex in its application and exacts tedious practice before it can be employed fruitfully.

I have, therefore, written this treatise, in which I have tried to include, in a brief space, all the literary instruction strictly necessary, as far as handling the instrument is concerned, to practical laryngoscopy.

G. H.

27a, Finsbury Square, E.C.,
May, 1881.

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THE

USE OF THE LARYNGOSCOPE

CHAPTER I.

DESCRIPTION OF THE INSTRUMENT.

Invention.

MANY unsuccessful, or rather, perhaps, disregarded attempts[1] to see the action of the living larynx had been made prior to 1854, when Manuel Garcia, a teacher of singing, actually caught sight of his own vocal bands in a small dentist's mirror pushed into the back of his mouth. Continuing his observations on his own throat, he was, at the end of a year, enabled to read a paper before the Royal Society[2] on the production of the voice, as elucidated by means of his invention. Garcia's device did not, however, attract much immediate notice; and it was only at the end of two years that Czermak, a German medical professor, commenced a systematic practice with the instrument, on himself and on patients, and showed finally the feasibility and facility of viewing the larynx during life. In the course of his observations he also made the general use of the instrument much easier, by pointing out a simple and scientific method of managing the light.

---

[1] These efforts have been described in detail by Mackenzie in his treatise, *The Laryngoscope*, London, 1871; and also by most of the authors mentioned in the Bibliography, p. 61.

[2] *Proceedings of the Royal Society of London*, vol. vii., No. 13, 1855.

As soon as Czermak had satisfied himself as to the actual value of the invention, he travelled into the chief cities of Europe, and, by giving laryngoscopic demonstrations before the principal physicians and surgeons of each town, achieved the introduction of the laryngoscope into medicine as an indispensable adjunct to the local study of disease.[1]

The laryngoscope, as now used, consists, in the first place, of a small mirror, called the laryngeal mirror, intended to be placed in the pharynx so as to reflect the parts below; and, secondly, of some kind of accessory apparatus, as a means of illumination.

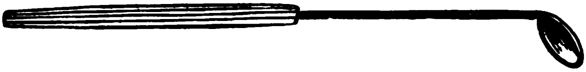
The Laryngeal Mirror.

This is now always made of thin glass, "silvered" at the back, and protected at the edges and behind by a casing of German silver or brass. It is fixed, at an angle of about 115°, on a metal stem, which is inserted into a long thin handle, the whole being about 7 inches in length. The handle should not be thicker than an ordinary penholder, as in using the laryngeal mirror it is most conveniently held like a pen. For the same reason the handle should be of such length (about 4 inches) that the fingers need not touch the metallic stem, as a loss of power in manipulating the instrument would be occasioned thereby. The stem may be fixed permanently in the handle, or merely retained by a large-headed screw, which should not be placed so as to hamper the fingers. I think it is an error to have the terminal end of the handle thick and club-shaped; it ought rather to be of uniform diameter throughout, or better, perhaps, slightly tapering towards the free extremity.

---

[1] A full account of the labours of Garcia and Czermak in relation to the laryngoscope has been given by Richard in his *Notice sur l'invention du laryngoscope.* Paris. 1861.

FIG. 1.

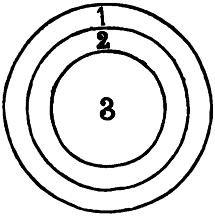


THE LARYNGEAL MIRROR.

The reflecting face of the laryngeal mirror may vary in shape and in size. Mirrors of a diamond form, almost square, the stem proceeding from one corner, are generally used on the Continent; but in this country circular ones are almost invariably preferred, whilst a small oval mirror is useful in certain cases.

As regards size, the laryngoscopist is usually provided with a set of three, the largest having a diameter of about 1⅛ inches, the next of ⅞-inch, and the smallest of ⅝-inch. They are spoken of as Nos. 1, 2, and 3, beginning with the largest.[1] The annexed diagram shows the sizes, as taken from a set in actual use.

FIG. 2.



SIZES OF THE LARYNGEAL MIRROR.

The Illuminating Apparatus.

When the laryngeal mirror is in its position in the pharynx a strong light must be thrown on its surface, in order that the image formed may be clearly seen by the observer. This light may be of two kinds, viz., reflected or direct.

I. REFLECTED LIGHT.—We may commence with reflected light, as it is that most commonly employed. Under this heading the means of reflection and the prime source of the light have to be considered.

---

[1] A fourth size still smaller, 5 lines in diameter, is used by the *Germans and* called No. 1, their largest being No. 4, thus reversing *the order given above.*

1. *The Reflector.*—The light is reflected on the laryngeal mirror by means of a circular concave mirror of about 3½ inches in diameter and 10 or 12 inches focus, which is attached to the face of the laryngoscopist. It is, therefore, called the *facial reflector.* This mirror is usually perforated at its centre by a small oval or circular aperture, because it is almost always worn over the right eye, and the observer looks through the opening when viewing the image of the larynx. In this position it shades the eyes from the glare of the light employed. Most frequently the central aperture passes through the glass of the mirror as well as through the metal back, but sometimes the silvering is only removed and the glass itself is not bored. The hole should not be too large—not more than $\frac{1}{6}$-inch in diameter—as it causes a slight central shade on the part illuminated, which of course increases in proportion to the extent of the opening. When the glass is not perforated this shade is lessened, as some rays are reflected by its surface, as well as from the silvering behind, a point which may be thought to make this arrangement somewhat preferable. In practice, however, the difference between the two kinds of visual aperture is not so marked as to render these considerations of much importance.

Strictly speaking, it is not necessary that the facial reflector should have any opening, as on account of the distance of the laryngeal mirror from the eyes (10 to 12 inches or more) the image of the larynx can be very well viewed with the uncovered eye alone, whilst the slightest movement of the patient or observer altogether interrupts vision of the larynx through the small hole. Thus the laryngoscopist, without constant attention to his position, will find that he makes very little use of the eye shaded by the reflector. For these reasons I entirely concur with Moura-Bouronillou[1] and others, that the best reflecting mirror for ordinary laryngoscopic purposes is one without an aperture, and that it should be worn on the forehead. Such a reflector casts no shade when in a proper position with respect to the source of light, whilst from its situation both eyes are left at perfect liberty to inspect the laryngeal mirror or to guide the hands in any required actions.[2]

The means of attaching the reflector to the face of the observer require consideration. Two methods are commonly employed, viz., (*a*) an elastic band (Kramer), passing round the head about the middle of the forehead, furnished with a metal plate in front to which the mirror is jointed; and (*b*) a stout spectacle-frame (as devised by Semeleder), made with half-rims only, the legs being hinged[3] behind (or being curved springs) so as to be bent backwards over the ears. The former arrangement is, perhaps, the steadiest, but the latter has rather the advantage that it can be put on and taken off with more rapidity. The semi-ovals of the front part of the frame may be worn above or below the eyes. When placed above they will be found to be more out of the way if the observer wears glasses, but in such case the required kind of lenses can of course be fitted to the spectacle frame itself.

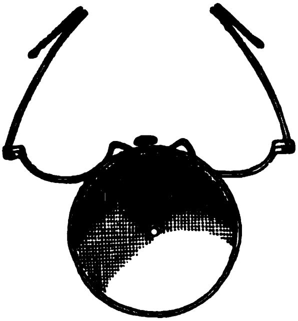
---

[1] *Traité pratique de laryngoscopie, etc.* Paris, 1864.

[2] It may be mentioned here, however, that the perforated reflector is indispensable when the practitioner requires to look closely at a small object, such as the membrana tympani, by reflected light, especially if with lenses or if the observer be short-sighted.

[3] The hinges should be covered with glove-leather to prevent *their entangling the hair.*

Fig. 3.



The Facial Reflector with Semeleder's Frame.

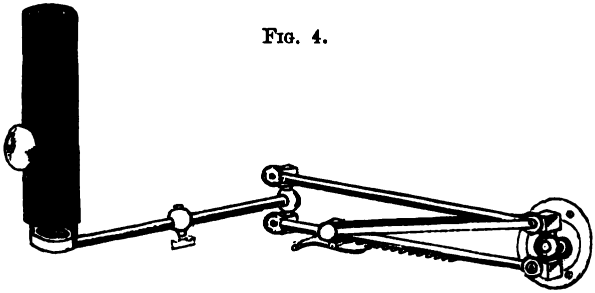
It is necessary to notice that the reflector is jointed near its edge at the back to the band or frame by a ball-and-socket joint. The capacity of the socket should be governed by a screw, so that the joint may be tightened according as it becomes loose through wear.

2. *The Source of Light.*—For this purpose some kind of lamp with a plano-convex lens before the flame is generally used. It must not be supposed, however, that a specially adapted light is absolutely essential. A good examination of the larynx can often be made at the bedside of the patient even by the aid of an ordinary candle. Laryngoscopy merely becomes more facile and pleasant as an art when practised with the most favourable arrangements. The best laryngoscopic lamp is generally one with a circular burner. Amongst

oil-lamps, the Silber-light answers perfectly. A plano-convex lens, about 2½ inches in diameter and of about 2 inches focus, may be attached to the chimney in a movable manner by any simple device. It had better be placed at about its focal length from the flame. Such lenses can be obtained from a lamp maker at a trifling cost; those with which bull's-eye lanterns are furnished are well adapted to the purpose. The advantage of using the lens is that the flame is thereby expanded to a disc-like form, which is thrown on to the fauces as an uniform disc of light by the facial reflector. Without the lens the concave mirror tends to project an image of the flame itself on and about the laryngeal mirror, whence results a small and irregularly illuminated patch which is not so satisfactory to see by. For this reason when a naked flame is employed, an extended one, such as that of a flat-wicked lamp or a gas-jet will be found preferable. If, however, the observer brings the light so close as to be well within the focus of the reflector, or if it be removed to a distance of 2 or 3 feet, the disadvantage of the naked flame can be greatly obviated.

Of lamps specially manufactured for the laryngoscope, Mackenzie's rack-movement lamp is in many respects the best. The essential part of it is a compound arm made of metal bars or tubing which can be varied in length by flexion and extension, and moved in a vertical or horizontal direction. It is usually adapted to burn gas, being fixed to the wall, and having a circular burner covered by a metallic chimney, in one side of which a lens is inserted, whence only the light issues. The arm can however, be made to hold a small oil-lamp at its extremity, and may be attached to a vertical bar rising from a foot of such weight and size as to allow the apparatus to stand on a table.

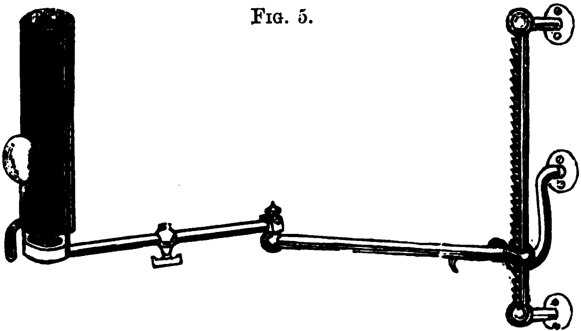
FIG. 4.



MACKENZIE'S RACK-MOVEMENT LAMP.

As, however, this lamp is somewhat heavy and complicated (having eight joints), I give a representation of a much simpler form, which I have been in the habit of using and found almost as efficient. On account of

FIG. 5.



THE AUTHOR'S ADJUSTING LAMP.

The rack is about a foot long, and the teeth should extend half way round the bar, to allow rotation of the arm in a semicircle. A small handle is fixed to the chimney, with which to turn it when hot.

the lightness of the arm, this kind is the most convenient when arranged merely to stand on a table.

II. Direct Light.—The highest amount of illumination of the laryngeal image can be obtained by direct light, as, of course, in reflecting light much of it is lost. In ordinarily employing this method, which is that almost universally preferred by French laryngoscopists, the facial reflector is cast aside, and the observer is stationed close behind the lamp which is placed on a level with and a few inches from the patient's mouth. The same kind of lamps as those just described can be used, but the glass chimney must have an opaque shield behind, so that the practitioner's eyes may not be dazzled, and another in front above the lens to protect the patient from the heat and glare; or a metal chimney perforated only in the position of the lens may be employed. A small concave reflecting mirror on the opposite side of the flame to the lens, in whose focus it should fall, greatly increases the light. The rack-movement lamps can be turned and placed so as to throw light directly on the fauces, but it is better that the lamp should be supported by a narrow or small round table steadily fixed to the floor.

For the purpose of demonstrating the laryngoscopic image well to lookers-on, as to hospital classes, a very brilliant light, such as that given by the oxy-hydrogen lime light, is required. In this instance the piece of lime, shielded by some kind of casing, may be fixed at the distance of a yard or more behind the demonstrator in the focus of a good lens of 2½ inches diameter, and 3 or 4 inches focus, by which the rays can be thrown, *in a parallel pencil,* on to the fauces of the patient.

Preferably the light should pass through a long tube, reaching to within about 10 inches of the patient's mouth, and capable of a radial motion round the lime as a centre, so that the illumination only becomes apparent in the desired locality. The lens also had better be movable backwards and forwards, so that the light may be modified practically to the most suitable brilliancy. The gas (equal parts of oxygen and hydrogen) can be allowed to play on the lime from a metal reservoir, into which it has been compressed, having passed through a Hemming's safety-jet, before ignition, in the usual way.

Solar light may also, of course, be used to illuminate the laryngeal mirror, either directly or with the reflector.[1] It is much less under command, however, than artificial light, and so is rarely employed. A good method is to allow a beam of suitable calibre to pass horizontally into a darkened chamber through a hole in a shutter, at the average height of the mouth when a person is in the sitting posture. In this case the results are very satisfactory on a bright day, especially if a body of white clouds are before the window. Or light taken directly from the sun may be reflected on the patient's face by an ordinary looking-glass placed at a suitable height and inclination near a window.

The student should observe the natural colour of the parts as seen by solar light, because the yellow rays of ordinary artificial flames cause the mucous membrane to assume a deceptively florid hue.

---

[1] A plane reflecting mirror is best when the sun itself, and *not merely diffuse daylight*, is employed.

CHAPTER II.

THE PRACTICE OF LARYNGOSCOPY.

THE optical principles connected with the laryngoscope are those of reflection and formation of images by plane and concave mirrors and refraction by lenses, as detailed in the various treatises on optics, wherefore they need not be further alluded to here. Their practical bearing on the ordinary use of the laryngoscope is not so great as to render a knowledge of them indispensable; but the student is nevertheless recommended to gain some familiarity with rudimentary optics, as he will then be in a position to manage the instrument with more certainty in some respects.

In giving directions for the practice of laryngoscopy, the subject may be treated in two divisions, viz., (1) the management of the illuminating apparatus, and (2) the management of the laryngeal mirror.

Management of the Illuminating Apparatus.

The first consideration of the laryngoscopist on placing himself before the patient is to get the parts *about to be* observed well lighted. The most convenient position is for both observer and patient to sit, their faces being directly opposite, at a distance of 8 to 12 inches, and the knees of the former embracing those of the latter. The lamp should be placed about 6 or 8 inches from the left side of the patient's head, the lens being turned so that its disc appears fully illuminated. In putting on the reflector, it is better to fix the mirror in a plane exactly vertical and parallel to the face of the wearer, as the light will then usually fall at once on the face of the patient, so that a very slight change of the inclination of the mirror will centre the light on the mouth. On the other hand, if the mirror be twisted in some oblique direction, the light will be thrown to a distance, perhaps on the wall of the room, so that the tyro may have some delay and difficulty in perceiving it and bringing it round to the required locality. When the reflector is worn over the eye (the right, as a rule), the hole must be placed so that it can be seen through, a point which should be ascertained at the outset. The reflecting mirror and the lens of the lamp should be on precisely the same level, and any dark patches appearing in the field of illumination are to be remedied by altering the position of the lamp as a whole, or only of the lens, perhaps, by rotating it slightly to one side or the other. It is best to judge of the purity of the disc of light thrown from the concave mirror by telling the patient to open his mouth, and observing if the fauces are perfectly illuminated.

When a naked flame is used, a more uniform field of light will be obtained when the lamp is removed *about 2 feet* further back than indicated above, or it may be moved to within 6 or 8 inches of the face of the practitioner.[1]

In using the laryngoscope at the bedside, it is best to get an attendant to hold the lamp or candle in the required situation, but it may be placed on a table or other article of furniture close to the bed. Daylight can also be used with the reflector, the patient being placed with his back to a window. The student should practise throwing the light not only when the lamp is in the conventional position, but when it is fixed in various other ways, such as at the right hand of the patient, etc.

When direct light is employed, the lamp should be placed straight before the patient's mouth at a distance of 6 or 8 inches, and, therefore, the observer must work with an arm on each side of it. In the case of the lime light the rays will stream in over his shoulder, or the tube may be sufficiently long to extend past the side of his neck.

As soon as the preliminaries respecting the illumination have been satisfactorily arranged, manipulation of the laryngeal mirror begins.

Management of the Laryngeal Mirror.

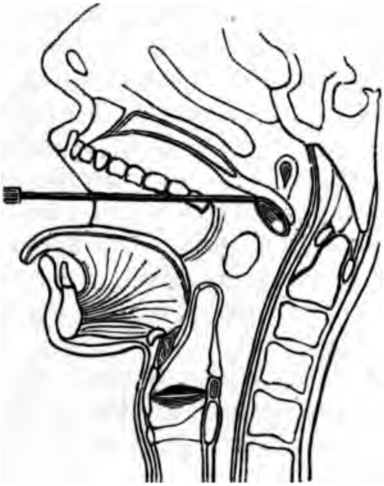
On taking up the laryngeal mirror with the view of examining a patient, the first requisite procedure is to heat it, for if placed cold in the pharynx its surface will be at once obscured by the moisture of the breath, which condenses on it. This heating is best effected by holding it, with the face downwards, over the chimney of the lamp for a few seconds. It must be noticed particularly that it is the face that should be held to the ascending current of hot air, as this is the part that it is essential to have warmed. On removing the mirror from over the lamp, the back should be pressed lightly to the cheek or hand of the laryngoscopist, to ascertain that this side, which is about to touch the patient's flesh, is not so hot as to burn. A good way to gauge the time necessary to hold the mirror over the lamp is, as Mackenzie remarks, to observe the moment when the film of moisture, which is at first deposited on its surface from the hot air, disappears. If it be withdrawn at the instant that the last patch of damp evaporates, it will usually be found to be just suitably heated.

---

[1] In the latter case the light is most brilliant, and the image of *the flame, having* become virtual, does not interfere.

The moment the mirror is ready the patient is desired to put out his tongue, which the laryngoscopist lays hold of gently, with a small cloth or handkerchief previously taken in the left hand. The mirror—held like a pen, with the thumb and two first fingers of the right hand, and with its reflecting face almost directly downwards—is then passed without delay between the tongue and palate into the pharynx. Its position here, generally most suitable to give a good view of the larynx, is with the uvula resting on its back, whilst its face looks forwards and downwards, at such an angle that the handle is nearly horizontal. The best position will, however, differ slightly in almost every case, as the anatomical conformation of the parts is not wholly similar in any two individuals. Thus it may be necessary to push the mirror lower down in the pharynx, or so much backwards that its edge touches the mucous membrane behind, or a greater elevation may be required, so that the soft palate has to be pressed upwards.

FIG. 6.



THE LARYNGEAL MIRROR IN POSITION.

After a little practice, these slight variations are made almost unconsciously by the laryngoscopist, who is guided in his manipulation of the mirror by the view which he obtains of the larynx.

In introducing the laryngeal mirror, it is important not to allow its face to come in contact with the tongue, lest it should become obscured by saliva. Touching the base of the tongue should especially be avoided, as irritation of this part provokes efforts of vomiting, which oblige the withdrawal of the mirror. The larynx is usually best seen when the tongue is put out, because this action draws up the organ, and also causes an elevation of the epiglottis, which otherwise is very likely to obstruct the view of the parts below. It is necessary to hold the tongue, as otherwise the patient generally moves it back involuntarily when he feels the mirror in the pharynx.

The medium-sized mirror is that almost always used with adults, the smallest answers for children, and the largest can be employed when the pharynx and larynx are very capacious, in order to have all the parts full in view at once.

The Image of the Larynx.—The appearance of the larynx, as seen in the dead subject, would scarcely enable the student to recognize the same organ, as viewed by the laryngoscope. The difference may be illustrated, hardly with exaggeration, by a comparison of the animated countenance of a living person with the face of a corpse. The larynx, performing its vital functions relative to breath and voice, gives the eye an impression of activity and boldness in detail, of which the flaccid and collapsed organ furnishes no conception. And in addition, the reflected image presents some peculiarities which heighten the distinction.

The position of the image in the laryngeal mirror with respect to the eyes of the observer is as if the larynx itself were regarded from behind and above. Thus, near the upper edge of the mirror, is seen the epiglottis, from which on each side proceed downwards and *inwards* the ary-epiglottic folds, covering the cartilages of Wrisberg and the arytænoid cartilages, till united at the lowest part of the mirror by the inter-arytænoid fold, the whole forming the irregularly circular boundary of the superior outlet of the larynx. Further down, in the vestibule, appear the ventricular bands,[1] beyond which, the entrance to the ventricles intervening, come into sight the actual vocal bands,[2] which form by their pearly white colour a striking contrast to the ordinary red hue of the surrounding parts. The corrugated surface of the interior of the trachea closes the laryngoscopic vista, although in cases the most favourable for examination, from fulness of development and steadiness of the patient, it is possible to see the bifurcation of the windpipe and the orifices of the bronchi.

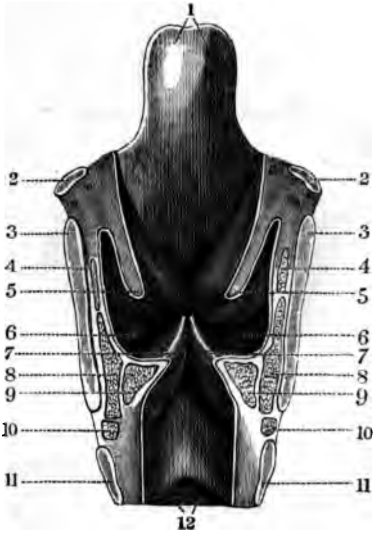
On account of the dioramic view the laryngoscopist is obliged to take, there is a great deal of foreshortening in the image of the larynx, so that the upper margin of the epiglottis and the vocal bands would scarcely be judged to be separated by a third of the real distance. The accompanying engraving of a vertical section of the larynx will prevent the student from falling into an error in this respect.

---

[1] Like the German *Taschenbanden*, as suggested by Mackenzie, op. cit., p. 74. Commonly called superior or false vocal cords.

[2] Almost universally called vocal cords in this country, a name given to them by Ferrein in 1741, because from some experiments on the larynx he concluded that they produced sound on the same acoustic principle as the strings of musical instruments. As this notion is now known to be false, I prefer to speak of them as *vocal bands* (like the German *Stimmbanden*). This suggestion has already been adopted in America. Questions of this nature are discussed at length in my *Treatise on Vocal Physiology and Hygiene*, 2nd edit., 1880.

FIG. 7.



TRANSVERSE VERTICAL SECTION OF THE LARYNX SEEN FROM BEHIND (NATURAL SIZE).

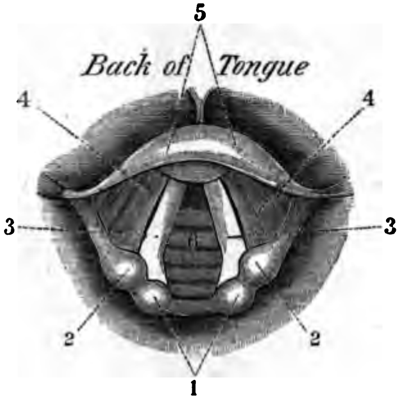
1. Epiglottis. 2. Tongue bone. 3. Thyroid cartilages. 4. Thyro-ary-epiglottic muscles. 5. Ventricular bands. 6. Ventricles. 7. Vocal bands. 8. Ext. and sup. thyro-arytænoid muscles. 9. Int. ditto. 10. Lateral crico-arytænoid muscles. 11. Cricoid cartilage. 12. Trachea.

When examining the larynx it is usually necessary to observe it under two aspects, viz., during (1) respiration, and (2) phonation or emission of sound.

1. *Respiration.*—The vocal bands during quiet respiration are in a state of constant but gentle motion to and from each other, separating slightly with inspiration and approaching again with expiration. With forced inspiration they retire apart to the widest extent, so as almost to disappear from sight below the ventricular bands. When it is desired to view the trachea,

THE LARYNX AS VIEWED WITH THE LARYNGOSCOPE.

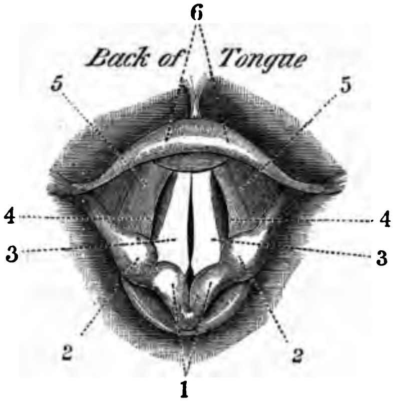
FIG. 8.



THE LARYNX DURING QUIET BREATHING.

1. Arytænoid cartilages. 2. Cartilages of Wrisberg. 3. Vocal bands. 4. Ventricular bands. 5. Epiglottis with its cushion below. 6. Trachea.

FIG. 9.



THE LARYNX DURING ORDINARY PHONATION.

1. Arytænoid cartilages. 2. Cartilages of Wrisberg. 3. Vocal bands. 4. *Entrance* of ventricles. 5. Ventricular bands. 6. Epiglottis.

the patient ought therefore to be told to draw a deep breath. In forced expiration, on the contrary, they come together very closely, and sometimes, indeed, nearly touch towards the end of the act. Thus the glottis, or interval between the vocal bands, varies at each instant. This space is unequally diamond-shaped during respiration, because the vocal bands form obtuse angles on each side, with the inner and lower edges of the arytænoid cartilages at their attachment to the vocal processes of the latter. The anterior triangle is the larger and lies between the vocal bands, its apex being in front on the thyroid cartilage. It has the same base as the posterior and smaller triangle, which has a truncated apex resting behind on the inter-arytænoid fold, whilst its sides are formed by the arytænoid cartilages. The posterior part of the glottis is therefore called the *cartilaginous glottis*, and its sides are about one-half the length of those of the anterior or *ligamentous glottis*. The lateral angles formed by the junction of the two become less obtuse according as the vocal bands separate, and at the extreme of forced inspiration are about right angles. On the other hand, when the bands are near together, each side of the glottis is in a continuous line.

When the larynx is closed hermetically to hold the breath, as occurs in strong muscular efforts, in the initiatory part of the act of coughing, etc., the ventricular bands can be seen to be pressed tightly together so that the vocal bands are completely hidden.[1]

In examining the larynx, it should be noticed whether the parts of opposite sides are quite symmetrical in every position. If one vocal or ventricular band appears to project more or less than the other, it is indicative of a morbid condition.

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[1] The mechanism of this action is fully considered in my work *cited above*, pp. 102, 126, 261.

2. *Phonation.*—Our means of generating sound by the larynx consist in closing the glottis by bringing the vocal bands into apposition at their edges, and then driving a current of air between them from the chest. Thus arise the vibrations which mainly constitute voice. This action can be well seen with the laryngoscope, when the patient is told to emit a vowel sound, which does not oblige much motion of the tongue. The best vowel for the purpose is generally *a*, as it occasions a rise of the larynx which brings the vestibule more fully into sight. The letter *e* causes a still further elevation of the larynx, but in this case the tongue must be held more firmly than usual, for otherwise it will intercept the view by approaching the palate. The position of the vocal bands in phonation is most perfectly seen when a note is sung. About the level in the musical scale of the ordinary speaking voice the ligamentous glottis appears as a thread-like fissure, and the vocal processes are pressed firmly together, but the cartilaginous glottis is not quite shut, remaining as a small triangular aperture, the apex of which is turned to the front. In ascending the gamut the vocal bands come by degrees more completely into sight in the laryngeal mirror, the inclination of which must, however, be altered gradually so as to meet the changes of position in the larynx. The anterior attachment of the vocal bands to the thyroid cartilage, which is

ordinarily concealed by the eminence called the cushion of the epiglottis, can often be perceived when a high note of the chest voice is sung. During phonation the entrance to the ventricles can also be well observed, especially if the mirror be moved more to the side of the pharynx, and inclined so as to reflect the opposite wall of the larynx.

In addition to the parts described, the laryngeal mirror may be used to examine the base of the tongue, the sides of the pharynx below the tonsils, and the orifice of the œsophagus. The latter appears as a mere fissure behind the arytænoid cartilages and inter-arytænoid fold, because it is always closed except during deglutition, vomiting, or eructation of wind.

Obstacles to using the Laryngeal Mirror.—Much as the practitioner may wish to see the interior of the larynx, he cannot always succeed in doing so by reason of some obstacle on the part of the patient. Cases, however, in which the attempt entirely fails are excessively rare, and confined mostly to children under three or four years old. As a rule the mirror can be introduced and the larynx surveyed successfully on the first occasion that the patient presents himself. The difficulties that sometimes arise may be classed under three headings, viz. (*a*) objection of the patient, (*b*) irritability of the fauces, and (*c*) unfavourable anatomical configuration.

a. Adult females occasionally, and very young children almost always strongly object to any instrument being put into their mouth or pharynx. In the first class of cases the difficulty can generally be sur-mounted by explaining to the patient that the instrument is only a small mirror, and, if permission to introduce it be granted, by taking care not to touch the parts with it nor to push it far back for the first two or three times that it is used. Under these circumstances, however, all idea of seeing the larynx must be abandoned until, by a few nugatory efforts with the mirror at the first and second sittings, the patient's fears have been dissipated. Then an examination can usually be effected without hindrance in the ordinary way. With respect to children, their opposition may sometimes be conquered by persuasion and perseverance, or the mirror may be introduced when the mouth is opened to cry, but in most instances no satisfactory attempt to see the larynx can be made. After three years of age this kind of obstacle rapidly vanishes.

b. Such extreme sensitiveness of the fauces sometimes exists that the slightest touch of the mirror, and even the mere consciousness by the patient of its presence, causes convulsive contraction of the pharynx, and efforts at vomiting. This condition generally diminishes greatly according as the throat is "educated" by repeated introductions of the mirror, but seldom disappears altogether. In such cases the practitioner may try to hold the mirror without touching any part, to facilitate which, instead of holding the tongue it may be merely pressed down in the usual manner so as to leave the pharynx widely open. If the patient can keep his own tongue steadily down so much the better. When every attempt of this kind fails, cold to the pharynx, by means of ice sucked for ten or fifteen minutes, as recommended by Mackenzie, may often be tried with success to subdue the sensibility. Another method, which has some continental reputation, is to give the patient fifteen or twenty-grain doses of bromide of potassium three times daily for a few days, with the view of producing anæsthesia of the pharynx, but the results of this treatment are rarely very striking.

c. The difficulties connected with anatomical configuration most frequently encountered arise between the tongue and the soft palate, in the pharynx, and from the epiglottis. In the first case the back of the tongue may be unusually elevated, or the soft palate may descend very low behind it, so that the mirror in the ordinary position is nearly out of sight. Under these circumstances the soft palate should be pressed away from the tongue in an upward and backward direction with the back of the mirror, or the laryngoscopist may try to see without holding the tongue out, as previously mentioned. When the uvula is elongated, it is likely to shut out the image of the larynx by its own reflection. The mirror should then be pushed lower and closer to the back of the pharynx. Sometimes the patient persists in breathing through the nose, and hence keeps the tongue tightly against the soft palate, but on desiring him to say *a*, a passage is at once opened for the mirror. In the next place, the pharynx may be blocked up by enlarged tonsils. Here the smallest mirror, or an oval one, with the long diameter vertical, may be gently pressed in between the tonsils. Finally, the epiglottis, which has a distinctive shape in nearly every individual, may hang over the larynx in an almost horizontal plane, thus obstructing all view of the *interior. To* obviate this difficulty the mirror may be passed lower than usual whilst the patient is made to pronounce or sing a vowel (*e* should be tried) in a high tone of voice. During the production of high notes the epiglottis rarely, if ever, shuts out the view, whilst, on the contrary, it almost always does so with grave tones and in the emission of low vowel sounds such as *u*, *o*, and *ah*. In extreme cases mechanical means for raising the epiglottis are occasionally resorted to, such as long and suitably curved forceps or hooks, both sharp and blunt (an Eustachian catheter may be tried); but from my own experience I am inclined to doubt whether there are any instances in which a little perseverance in placing the mirror and in trial of methods of phonation will not be rewarded by sufficient glimpses of the interior of the larynx.

Inferior Laryngoscopy.—Examination of the larynx from below, in cases of tracheotomy, has been practised with success by Semeleder and others. A very small mirror with its face turned upwards at a proper angle is passed into the canula, which for the purpose must have an opening on its upper side.

Autolaryngoscopy.—By this is meant examination of one's own larynx. One method is to sit before an ordinary looking-glass with the mouth open, tongue out, and the laryngeal mirror inserted by one hand, proceeding otherwise exactly as when observing another person. A simpler way is to sit with the back to a window, the laryngeal mirror in one hand, and a *small plane* one in the other, the latter serving both to *throw the light* and produce the image. An instrument called an autolaryngoscope (Czermak's) is also used with somewhat more convenience. It principally consists of two upright stems, about 10 inches apart, the one in front bearing at its summit a small plane mirror, and the other behind a concave reflector. The latter throws the light on the fauces from a lamp beside the observer, shaded in the direction of his eyes, and the plane mirror takes the same part as in the other cases. Autolaryngoscopy affords an opportunity of regarding the larynx and all its actions at leisure, and the student is therefore advised to have recourse to it.

Another kind of autolaryngoscopy is encouraged by French laryngoscopists, who employ for the shield already mentioned, which surmounts the lens of the lamp when used for direct light, a small plane mirror, so that the patient can observe his larynx simultaneously with the practitioner.

CHAPTER III.

OPERATIONS BY THE AID OF THE LARYNGOSCOPE.

In the instructions given in the previous chapters the laryngoscope has been seen as a means of diagnosis. It now remains to consider it as an aid to treatment. It is in this field that the real and practical utility of the instrument becomes most manifest, since, without the ocular proof it affords, the practitioner would often have to go to work blindly when trying to cure many diseases affecting breath and voice. This part of the subject may also be discussed in two divisions, *i.e.*, (1) medication of the larynx, and (2), laryngoscopic surgery.

Medication of the Larynx.

We may comprise in this section an account of all direct applications of drugs to the larynx, whether in the form of (1) solutions, (2) solids, (3) powders, or (4) inhalations, and also of (5) electricity.

1. *Solutions.*—There are few cases of objective laryngeal disease which cannot be benefited by suitable solutions directly applied. For the purpose brushes *will generally* be found most convenient. The brush

should be mounted at the end of a stout wire, curved to enable it to be passed down the pharynx, and preferably of aluminium, as this metal does not rust readily, and can easily be bent if required. The wire must be fixed in a long and thin handle, which may be similar in every respect to that of the laryngeal mirror.

In holding instruments, however, to be dipped into the larynx, it will generally be found most convenient to grasp the handle so that its end rests against the palm of the hand, and with the index finger extended along the upper side to command any springs or other adjusting devices which are often in this situation. On this account the handles of instruments may, unlike the mirror, have with advantage a rather thick and rounded or polygonal end. Some laryngoscopists prefer holding their instruments by means of two vertical rings, through which pass the two first fingers, whilst the thumb acts at the end of the handle on any subordinate mechanism, or the rings may be movable.

I advise that the brush should not be held like a pen, but similarly to the other instruments, so that in the frequent applications of solutions the hand may gain and retain the dexterity required for the more difficult operations.

The part of the wire bearing the brush had better be at right angles to the direction of that joining the handle, the two becoming continuous by a short but not too angular curve.[1] Brushes of different lengths in the vertical portion will be required, and of these two sizes are sufficient, one shorter, in which the hairs terminate about 1½ inches below the level of the handle, and the other an inch longer. The first will reach easily to the margin of the larynx, and the second to the vocal bands. Below the latter it will seldom be possible to penetrate. As regards the shape of the brush itself, it should be bushy when a large surface has to be mopped, and formed to a point when a small patch only requires to be touched.

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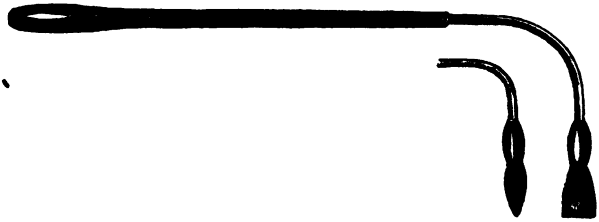
[1] This is the general form of all laryngeal instruments. Another pattern (Mackenzie's) is also occasionally used, in which the stem is bent almost at a right angle. The object of this shape is to avoid any *chance of contact with* the base of the tongue and epiglottis. After

FIG. 10.



LARYNGEAL BRUSHES.

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some experience with them, however, I have found that the angle necessitates an irregular course on introduction and withdrawal to steer clear of the palate, whilst if the point is required to act at the anterior wall of the larynx the angle is even likely to come into inconvenient collision with the back of the pharynx. On the other hand, in practice the well-curved instruments can be passed in an even and steady manner with perfect freedom from touching any part, and their uniform motion can be followed more easily in the laryngeal mirror. In some cases, indeed, it is advantageous to raise the epiglottis with the shank of the instrument. For these reasons I cannot recommend the angular instruments, an opinion in which I think there are few laryngoscopists who do not concur; most of them, in *fact, employ* a complete catheter curve.

In applying solutions to the larynx it is usual for the patient to hold out his own tongue while the operator inserts the mirror with the left hand and uses the brush with the right. It is best to pass the brush carefully by one side of the epiglottis to the space between that valve and the back of the pharynx, and then directly on to the larynx, the motions being guided by observing the images in the laryngeal mirror. The student should practise this little operation until he can do it skilfully, as the manipulative procedure is the chief part of every other operation performed on the larynx through the natural channel. When, however, it is only necessary to mop the upper part of the larynx with the short brush, the mirror need not be employed after a familiarity with the relations of the parts has been gained. If the brush be passed down the pharynx, close to its posterior wall, for a couple of inches, a little forward movement can then scarcely fail to bring it in contact with the larynx. But this method will be uncertain should the epiglottis be long and pendent, a point which, of course, will have been previously ascertained by the mirror.

The brush should be well wetted with the solution, but should not be so full that a quantity of fluid runs out the moment anything is touched.

Instead of brushes, small sponges or pledgets of lint, similarly mounted, except that they must be retained by a movable catch, may be employed. They have, of course, to be thrown away after being once used. They do not part with the fluid so readily as the brushes, unless pressed firmly against the part, and then a *too copious* stream flows out.

2. *Solids.*—In treating ulcers and small growths in the larynx solid caustics may have to be applied. They should be fixed very securely at the end of stems having the same general form as those of the brushes, and in small pieces only, as considerable danger might result from their becoming accidentally detached and falling down the windpipe. They may be guarded so as only to be extruded at the desired moment on pressing a spring. The ordinary remedy of this class is nitrate of silver, which can be used with perfect safety if the end of a curved rod be merely coated with it by being dipped into the fused salt. For this purpose the handle and aluminium wire of the brush answer well.

3. *Powders.*—Astringent and sedative powders can be blown into the larynx through a tube of wood, vulcanite, or other material, curved at one extremity for a short distance. The powder must be put into the tube near the end whence it is to issue through an opening that can be closed by a movable collar. The blowing can be performed by the mouth, in which case a flexible tube about a foot long with a mouth-piece is attached to the powder-bearing tube, or by a hollow india-rubber ball (Rauchfuss' method). The first method is the best, as the action of compressing the ball jerks the tube from the desired position when the powder is expelled. A stronger and more lasting effect is obtained by powders than by solutions, but they are too widely scattered by the insufflation to allow of their being available, unless where a large extent of surface is diseased.

4. *Inhalations.*—Inhalation provides a very important means for local treatment of laryngeal disease, to be carried out by the patient himself, and therefore requires notice here. There are two principal methods of inhaling drugs, viz., (*a*) by breathing the steam rising from hot water which contains some of the medicament, and (*b*) by inspiring a solution of the substance in the form of a fine spray.

a. For the ordinary hot-water inhalation the drug must possess more or less volatility (essential oils are mostly used), and the vessel should be arranged so that the air drawn in by the patient passes first, not only over, but also through the water. The top of the inhaler should therefore be covered, excepting where there is a mouth-piece for the patient to inspire from, whilst the channel of supply for the air should dip below the surface of the fluid. Of vessels manufactured for the purpose on this principle, Mackenzie's "eclectic inhaler" is undoubtedly the best; but several others, much more simple and inexpensive, and almost as effective, can also be obtained. The temperature of the water used may vary from 140° to 160°.

b. Spray-producers are made either on the well-known principle of Bergson's tubes, or so that a minute stream of the fluid, by being driven forcibly against an opposed surface, becomes dashed into particles (Sales-Girons' device). Bergson's tubes consist of an upright one, open at both ends, which dips into the solution below, and of a horizontal one through which a current of air or steam is propelled across the top of the other. The air is supplied by working a hollow india-rubber ball *with the* hand, whilst the steam may be obtained from a small boiler, closed except at its opening into the horizontal tube. Inhalers of the latter kind are self-acting, and were invented by Siegle. A much finer spray is produced by either method of using the tubes than by the mere breaking up of a jet of liquid, and they should therefore be preferred for the larynx, as the lighter particles are more likely to be copiously drawn into the organ by the breath.

In addition to the above means of inhalation, volatile drugs, such as ether, chloroform, etc., can be inhaled simply by inspiring through sponge or lint soaked in the fluid. The smoke from burning substances, such as stramonium and nitre, can also be utilized for inhalation, especially in cases where anti-spasmodic effects are required, as in asthma.[1]

5. *Electricity.*—The application of the faradic or interrupted current to the intrinsic muscles of the larynx is of great value in cases of functional aphonia, chiefly occurring in hysterical females, and also in some rather rare forms of myopathic paralysis and weakness of the vocal muscles. The most convenient apparatus is a small one-celled battery, strengthened by an induction coil, with the negative pole of which is connected a metal disc, to be held against the outside of the larynx, over the lower part of the thyroid cartilage, by a band passing round the neck, and with the positive pole Mackenzie's laryngeal electrode. The latter instrument is an insulated curved wire, terminating in a

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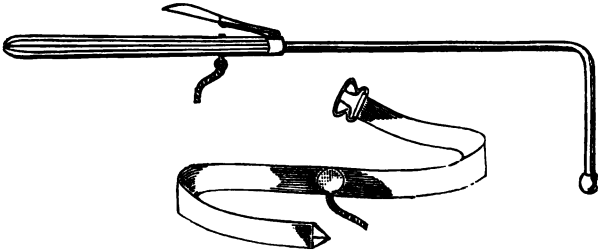
[1] For detailed prescriptions the reader may refer to the *Throat Hospital Pharmacopœia*, into which almost all formulæ of value have been diligently collected by the editor.

small knob, mounted with handle, etc., and arranged so that the current need only be allowed to run by pressing a spring when the desired part is touched. The electrode is to be passed into the larynx by the aid of the laryngeal mirror as described, though in cases where great precision is not demanded the mirror need not, after a little practice, be used simultaneously. The electrode should only be kept in contact with the larynx for about a second, unless the patient shows great insensibility, and should then be withdrawn. Three or four such introductions are usually enough for one sitting. In the intervals between passing the electrode inside, it may be applied to the outside of the larynx at various points. The secondary current is usually employed, and its force must be regulated according to circumstances, by the arrangement provided for doing so. When it is desirable to stimulate the course of particular muscles only, an electrode, connected directly with both poles, and having a biped extremity, as suggested by Fauvel, may be employed, in which cases the external collar is, of course, dispensed with. This exactitude is, however, but rarely altogether

FIG. 11.



MACKENZIE'S LARYNGEAL ELECTRODE AND NECKLET.

imperative. The electro-magnetic (or dynamic) machine, which is set in action by turning a handle, may be used instead of the battery, the only disadvantage being that the instrument cannot well be worked without the aid of a third person.

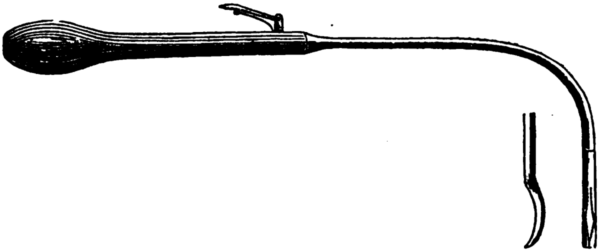
Laryngoscopic Surgery.

Intra-laryngeal operations of an essentially surgical nature are undertaken for (1) the relief of œdema, (2) the removal of morbid growths, (3) dilatation of the channel, and (4) the extraction of foreign bodies.

These operations cannot, of course, be attempted until after considerable practice in performing the simple ones described in the last section.

1. *Œdema.*—Œdema of the larynx, from whatever cause, may generally be much relieved, and sometimes even tracheotomy may be avoided, by scarification of the tumefied parts with a laryngeal lancet. This instrument consists of a fine blade, fixed to a curved stem and handle of the usual form. The blade itself may be of

Fig. 12.



Laryngeal Lancets.

various shapes, but one about half an inch long, resembling a small sharp-pointed bistoury, and a small spear-shaped blade, guarded so as to be protruded a quarter of an inch at the required moment only by pressing a spring in the handle, are the kinds most to be recommended.

In performing the operation, the mirror being held with the left hand, the lancet is introduced with the right to the desired spot, and a vertical cut is then made in withdrawing it. Unless the patient is unusually steady only one cut can be made at a time, and both mirror and lancet must be taken out together for a few seconds, to allow the patient to recover himself. The parts requiring to be incised are ordinarily the side-walls of the larynx, from the ventricular bands upwards. When the œdema is general three scarifications may be made on each side, one close to the epiglottis, one near the arytænoid cartilage, and a third midway between the two. They should be about $\frac{1}{12}$-inch to $\frac{1}{8}$-inch deep, and $\frac{1}{6}$-inch to $\frac{1}{3}$-inch long, according to the amount of tumefaction and the size of the larynx. Circumscribed œdema must be incised as appears most suitable. If the vocal bands are œdematous they must be pricked or scarified longitudinally with the spear-shaped lancet, as vertical incision would be likely to give rise to a permanent affection of the voice. As a rule, however, the fatal closure of the glottis in cases of œdema is produced more by infiltration of the surrounding structures, by which the vocal bands are forced to maintain a state of dangerous approximation, than by swelling of the bands themselves.

Abscesses in or about the larynx can be opened with *the laryngeal* lancet in the manner just described.

It is important for the student to observe that in laryngoscopic operations the actions can rarely be seen completed in the mirror. Owing to the mobility of the larynx, both as a whole and in its parts, and its sensibility, the contact of the instrument soon causes a spasmodic contraction of the vestibule and a forced ascent of the organ towards the base of the tongue, by which the possibility is precluded of following the operation to its conclusion with the eye. The laryngoscopist, therefore, is generally guided in the latter part of his operations by his mental picture of the locality and whatever tactile sensations the point of the instrument affords. It is well to note here that before introducing instruments into the larynx they had better be warmed.

2. *Morbid Growths.*—Neoplasms are of very frequent occurrence in the larynx, and in most cases they can be operated on successfully by the aid of the laryngoscope through the mouth.

In a very large proportion of cases the growths are of a tender structure (papilloma) and more or less distinctly pedunculated (fibroma),[1] so that, if seized, they can be easily removed by methods of evulsion. In most instances the only difficulty is to lay hold of the tumour; and when it is comparatively small and deeply situated, unless the patient be remarkably steady and the interior of the larynx in full view, the operation will often exact a good deal of patience and perseverance. On this account the works of laryngoscopists, especially of the continental, abound with figures of growth-extracting instruments,[1] some of which doubtless have never been used successfully, or, at least, have only served their purpose in single instances. This circumstance, however, well illustrates the fact that the extirpation of small laryngeal growths is sometimes a matter of extreme difficulty, whilst it may be supposed that the ultimate success has generally been due less to the ingenuity of the instrument used than to the dexterity acquired after repeated attempts.

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[1] For a description of the varieties of laryngeal polyps, see Mackenzie's *Essay on Growths in the Larynx*, 1871.

Those who wish to operate skilfully on these little tumours, I should advise to confine their efforts as far as possible to obtaining a thorough command over the ordinary laryngeal forceps. It is, indeed, scarcely an exaggeration to say, that the laryngoscopists who have removed the largest number of polyps, have employed the fewest instruments. The ordinary forceps have the usual length and curve of laryngeal instruments, are held like a pair of scissors, and may have plain or serrated blades which open in a lateral or an antero-posterior direction. Two sizes, corresponding to those mentioned when describing brushes, are required. The antero-posterior forceps may be employed in almost all instances, as the internal surface of the larynx is formed mainly by the side-walls, whence the growths project towards the mesian line, whilst even in the case of polyps springing forwards or backwards the same forceps can be turned to them with facility, and are nearly as manageable as the lateral ones. A third kind, in which one blade is pressed down on the other, is occasionally required when the growth has an extensive base in a horizontal direction.

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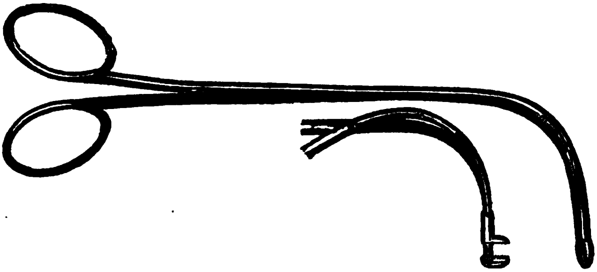
[1] To these as well as to many other instruments, which may be included in the same category, no further allusion need be made in this work. A description of them could only possess interest for those who take up laryngoscopy as a speciality, and would in fact fill a volume, which might be entitled with propriety "Curiosities of Laryngoscopy."

Fig. 13.



Ordinary and Horizontal Laryngeal Forceps.

The forceps should be introduced with great care, so as to avoid touching any part until the blades surround or are very close to the growth, and when the contraction of the larynx hides the view in the mirror the operator must continue his action without wavering, until he believes he has grasped the polyp, when it should be torn away with moderate force. If the resistance appears great he had better relax and withdraw the blades if he is not quite certain as to the nature of the growth and that he has seized it properly. Should two or three attempts result in failure to catch the tumour, it will be useless to pursue the operation further at the same sitting, and the patient must be left for a day or two to regain his firmness. Sometimes the mere crushing of the growth by the forceps causes its death, and it afterwards comes away spontaneously without further treatment. As each case presents some distinctive features, a little practice with respect to it is likely to be required by the operator, but more especially because the patient gains thereby an habitude in submitting himself to the introduction of the forceps. The foregoing directions apply chiefly to polyps situated on or near the vocal or ventricular bands, as those about the margin of the larynx and the epiglottis can often be taken away at the first trial. In almost all cases, however, if the growth be large and irregular, it must be removed in successive portions at intervals of one or two days.

Besides the ordinary forceps, instruments of other designs may sometimes be employed with advantage for the extirpation of polyps. Such are tube-forceps, in which the blades are generally made very small, and so as to remain open until brought together by the tube through which their shanks pass being pressed over their neck; sounds (or probes, thin blunt-ended bars, rounded or angular); straight and curved blades of various shapes and sizes like the laryngeal lancet; and lastly, wire loops or snares and guillotines or ring-shaped knives (like the ordinary tonsillotome, Fahnstock's or the other patterns), with which the growth being encircled is strangled or cut off. The merit of tube forceps, sounds, lancets, and wire loops consists in the smallness both of their stems and extremities, which enables them to be introduced further into the larynx without touching the structures, whilst they do not shut out the view of the parts in the mirror. The sounds and lancets are sometimes particularly valuable, as they can be insinuated into the glottis so as to rub, cut, or scrape off diminutive polyps on the edges of the vocal bands, which often elude all attempts with other instruments. The sounds are also sometimes required in order to ascertain the attachments and mobility of tumours of which the laryngoscope does not afford a full view. Guillotines are mainly useful in the case of tough fibrous growths, which are usually very decidedly pedunculated, but unless the ring can be seen around the tumour, merely tactile efforts are almost invariably fruitless.

Growths can also be destroyed by caustics and strong astringents, such as silver nitrate and saturated solution of perchloride of iron. Sessile tumours which offer no projection that an instrument can catch may be attacked in this way. Finally, it may be remarked that laryngeal polyps, which through position or small size give rise to no pressing interference with respiration or phonation, need not be subjected to any treatment.

3. *Stenosis of the Larynx.*—Concentric narrowing of the vestibule of the larynx or the glottis is often the result of syphilitic ravages or wounds in the vicinity, and forms so serious an impediment to respiration as to demand the aid of the laryngoscopist. Gradual dilatation may be resorted to for the relief of this condition, before or after tracheotomy, according to the urgency of the symptoms. Several dilators have been invented for the purpose, most of them on the principle of inserting two or three blades or prongs into the larynx in a state of closure, and then forcing them apart by degrees on turning a screw in the handle. The amount of pres-

sure must be in proportion to what the patient seems readily to bear, and may be increased, as well as the time of its application from day to day. This operation is seldom attended with any difficulty; but the results are often negative, as the cicatrices have an obstinate tendency to recontract in a short time after the treatment has been left off. In order, therefore, to obtain decided benefit the daily use of the dilator will have to be persevered in for many months, whilst its resumption is likely to be required again and again during a period of some years.

Two other methods of dilatation have been employed with considerable success within the last few years by Schrötter,[1] viz., dilating tubes and plugs. The tubes are curved, of graduated sizes, and taper slightly at the end that is to be introduced into the larynx. The patient breathes through the tube when it is in position, and retains it on each occasion for ten or fifteen minutes, or as long as he can support it. The plugs are of lead, about 1¼ inches long, of various diameters, and can only be used after tracheotomy. They are dropped into the larynx by means of a curved tube, to the end of which they are held by a long string passing through it. The tube is then withdrawn, and the string attached to the ear of the patient. At the same time the lower part of the plug is received in an opening at the upper side of the canula where it is fixed by a small bolt being thrust into it. The plug may be thus worn for the greater part of each day if the patient can sustain it, whilst its size is increased according as the dilatation progresses.

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[1] *Beiträge zur Larynx-stenose*, Vienna, 1876.

Sometimes the stenosis has a membranous character, when a narrow cicatricial band in its contraction draws the mucous membrane out around, much in the way that a running-string closes the mouth of a bag. A membranous attachment between the anterior part of the edges of the vocal bands is occasionally met with as a congenital malformation, causing a serious impediment to phonation. It may also follow the healing of ulcers in the same situation. In such cases division of the membrane with the lancet, or by Whistler's cutting-dilator,[1] is indicated, and often effects an immediate cure without any tedious course of dilatation.

4. *Foreign Bodies.*—Foreign bodies arrested in the larynx can be extracted with the ordinary or tube forceps in a manner similar to that described when treating of the removal of polyps. Great care, however, must be exercised in trying to seize the body lest an awkward movement should thrust it into a worse position, or even down the trachea. Occasionally the substance becomes immovably fixed by the swelling which its presence at first excites; and under these circumstances it may be necessary to defer any attempt to remove it until the tumefaction has subsided.

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[1] One with two blades, from between which a knife can be forced out on pressing a spring. I have not thought it necessary to describe minutely the mechanism of laryngeal instruments, as they are now so well known to surgical instrument makers. Messrs. Maw, Son and Thompson, of Aldersgate Street; Messrs. Mayer and Meltzer, of Great Portland Street, and others, have a large and varied stock from which a selection can be made.

CHAPTER IV.

CASES IN WHICH THE LARYNGOSCOPE SHOULD BE USED.

A BRIEF review of the general phenomena of laryngeal disease and the symptoms which should cause the practitioner to hesitate in his diagnosis until he has seen the larynx, will probably be read here with advantage.

The leading symptoms usually associated with morbid conditions of the larynx are in their order of frequency, (1) cough, (2) alteration of voice, (3) difficulty of breathing, and (4) difficulty of swallowing.

1. *Cough.*—There are few cases of laryngeal disease altogether without cough, and in some instances it is the first, and, for a time, the only symptom. Taken alone, however, it furnishes no reliable index to the magnitude of the lesion, being sometimes pronounced with slight cause, and *vice versâ.* It accompanies all ordinary inflammatory affections of the larynx, and as a very trivial congestion will often suffice to excite it in a marked manner, it frequently betrays laryngeal phthisis, syphilis, tumours, and cancer, before the structural alterations are such as to embarrass the organ in any other way. Recent coughs, therefore, if

not of obvious origin, and all persistent coughs demand the use of the laryngoscope. In phthisis it is especially important to know if the larynx participates in the malady, as in such case the prognosis against the indefinite prolongation of life so common in merely pulmonary consumption is greatly strengthened.

2. *Alteration of Voice.*—Although almost any lesion of the vocal tube from the glottis to the mouth or nostrils will produce this symptom,[1] yet hoarseness, if at all decided, indicates, as a rule, some morphological or substantial modification of the vocal bands. They may be found ulcerated, swelled, congested, or coated with viscid secretion. But a slight change of condition at their actual edges will affect voice more than extensive alterations elsewhere. Thus, persistent marked hoarseness may arise from a minute polyp in this situation, whose presence on any of the adjacent parts might never be known.

In ordinary superficial catarrh of the larynx, shallow ulceration along the edges of the vocal bands will often reduce the voice to a mere whisper for long after all other symptoms have disappeared. Polyps may have a similar effect without other symptoms being prominent. These results are most usual in females, as is also functional aphonia; but the laryngoscope alone can determine whether careful, and perhaps prolonged treatment with the brush and inhalations, operation with the forceps, or a few touches of the laryngeal electrode are demanded.

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[1] A muffled tone is the usual characteristic conferred on voice by affections of the pharynx, mouth, and nose.

3. *Dyspnœa.*—Shortness of breath is the natural consequence of narrowing of the glottis by tumefaction, cicatrices, large polyps, spasm, paralysis of the abductors of the vocal bands[1] (posterior crico-arytænoids), or foreign bodies. Stenosis of the trachea from cicatrices, or pressure of external tumours, also occurs, and can be recognized by the laryngoscope. In most of these cases inspection only of the larynx can differentiate these affections from each other with certainty.

The importance with respect to treatment and prognosis of distinguishing beyond doubt the dyspnœa of laryngeal disease from that of chest lesions is too obvious to be dwelt on, except to remark how indecisive in such instances is likely to be an examination by the stethoscope alone.

4. *Dysphagia.*—In chronic laryngitis—simple, phthisical, or syphilitic—and in carcinoma, deglutition is often greatly impeded. Under these circumstances the epiglottis, or the region of the arytænoid cartilages, will be found much swollen or ulcerated, so that the pressure of the bolus or of the tongue alone during the rise of the larynx causes acute pain as well as a sense of obstruction. Without the laryngoscope I have known such cases to be mistaken for stricture or malignant disease of the œsophagus.

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[1] The tone of the voice is not altered in this malady, as the vocal bands and the power of approximating them remain intact.

CHAPTER V.

RHINOSCOPY.

By reversing the position of the laryngeal mirror so that its face is inclined upwards and forwards, an image may be obtained of the parts bounding the upper or naso-pharynx. By this means the practitioner may observe the back of the soft palate, the septum nasi, the orifices of the posterior nares with the turbinated bones, the pharyngeal aperture of the Eustachian tube, and the abutment of the pharynx on the base of the skull and arch of the atlas. Employed in this way the laryngoscope is transformed into the rhinoscope, and the art of so using it is termed rhinoscopy, or more definitely, posterior rhinoscopy.

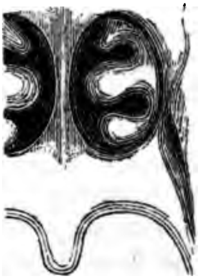
Rhinoscopy is, however, by no means so uniformly satisfactory by its success in practice as laryngoscopy, owing in part to frequent narrowness of the interval between the back of the pharynx and the soft palate, but chiefly to the mobility and sensibility of the latter organ which, in many cases, provoke its retraction so as to shut out the view the moment the mouth is opened or the mirror is placed in position. Nevertheless much valuable aid in diagnosis is often derived from the rhinoscope: the true seat of ozœna, the actual root of polyps, occlusion of the Eustachian tube, syphilitic ravages in the nasal meatus, etc., which could not be inspected by any other means, may frequently be observed.

For the purpose of rhinoscopy, it is well to take the smallest laryngeal mirror and bend the metal stem slightly backwards about the middle of its length, by which procedure a curve is formed to accommodate the dorsum of the tongue. The mirror itself should also be bent on the stem, so that the face looks more directly forwards. Specially constructed rhinoscopic mirrors are always made of this form. Of these, Fränkel's is the most convenient, as the inclination of the mirror can be altered by moving a ring attached to the handle with the forefinger.

In employing the rhinoscope the tongue is not held out, but must be kept down by the patient, or pressed down by the observer, so as fully to expose the pharynx. On this account a tongue depressor is sometimes movably attached to the rhinoscopic mirror. It must next be seen that the soft palate is depressed, as otherwise it will be useless to introduce the mirror. If then this organ does not interfere, the mirror is to be passed into the pharynx, with its face forwards as indicated, when a reflection of some part of the posterior nares will probably be seen in it. It is unnecessary to touch any of the structures with the mirror except the back of the pharynx, and even this had better be avoided unless the patient evinces no irritability during the examination.

The view obtained by the rhinoscopic mirror differs according to its position in the pharynx, and the inclination given to its surface. If it be not pushed far enough backwards, images only of the roof of the mouth and backs of the teeth will be formed. When suitably placed in about the centre of the pharynx, the back of the uvula and the septum nasi can be seen. Moved or inclined a little to one side, the posterior orifice of the corresponding nostril comes fully into sight, almost filled by the peculiar rounded eminences of the turbinated bones (superior, middle, and inferior) which project from the outer wall, and are separated from each other by the nasal meatus. In a nearly horizontal position the mirror shows the vault of the pharynx, whilst if moved near one side of that cavity and inclined slightly outwards, the funnel-shaped aperture of the Eustachian tube, surrounded by its tuberosity, can be observed.

Fig. 14.



View with the Rhinoscope (right side).

When the soft palate, by its retraction, prevents the use of the rhinoscopic mirror, the observer should tell the patient to breathe through the nose,[1] the mouth being kept open and the tongue depressed. The effort to perform this act will often cause the soft palate to be dropped, and then the mirror may be introduced carefully. Should its presence provoke the re-elevation of the soft palate the direction may be repeated. If, however, the organ remains obstinately retracted, recourse may be had to a palate-hook, a broad, flat hook, somewhat like a spatula bent backwards into a curve at the end. This instrument is to be inserted between the back of the pharynx and the soft palate, in order to draw the latter forward. The patient should be told not to resist the action of the hook, by the use of which a sufficient space may often be obtained for the successful employment of the mirror. Should all such attempts fail, and it is absolutely essential to see the parts, the last resource is, as advised by Fränkel,[1] to make the patient, by practising before a looking-glass, acquire the power of relaxing his soft palate at will.

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[1] This is, of course, an impossibility, unless the mouth is shut or the tongue pressed against the back part of the palate; but the relaxation of the soft palate being necessary to the act is often a consequence of the direction.

If the uvula is elongated it must be avoided by keeping the mirror to one side, but when it is much enlarged it had better be raised with the palate-hook. For this purpose alone, however, I have found a stout wire, twisted into a ring of suitable size and bent downwards at one end, the most convenient instrument.

Apart from rhinoscopy, the student will remember that much information respecting naso-pharyngeal disease may generally be obtained by digital exploration, *i.e.*, by passing the index finger up behind the soft palate, when tumours or any marked structural alterations of the parts can be felt.

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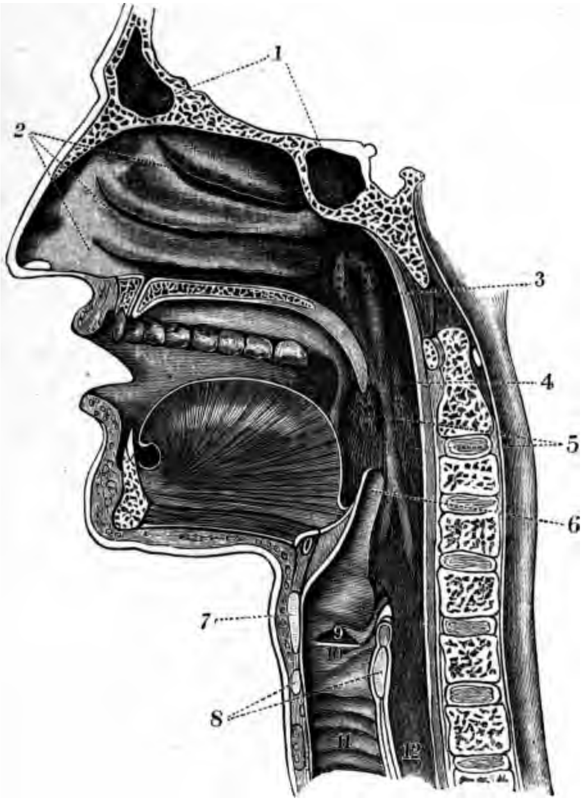
[1] Ziemssen's *Cyclopædia of the Practice of Medicine*, vol. iv., p. 65.

In the treatment of diseases diagnosed by the rhinoscope, many of the laryngeal instruments described, those which are shorter in the curved portion, can be conveniently used. Thus solutions may be applied with the brush, polyps can be extracted with the forceps, etc., the mirror being introduced simultaneously when precision is required.

As regards anterior rhinoscopy, a light need only be thrown up the nostrils with the reflector, whilst the patient holds his head back. To facilitate the view the orifices of the nostrils may be dilated, for which purpose Fränkel's well-known nostril-dilator answers admirably. In the absence of an instrument of the kind, however, an ordinary scissors-pattern dressing-forceps can be used very effectively.

Fig. 15.



GENERAL VIEW OF THE PARTS EXAMINED IN LARYNGOSCOPY AND RHINOSCOPY.

1. Frontal and sphenoidal sinuses. 2. Superior, middle, and inferior meatus. 3. Eustachian orifice. 4. Uvula. 5. Pillars of fauces with tonsil. 6. Epiglottis. 7. Thyroid cartilage. 8. Cricoid cartilage. 9. Ventricle of larynx. 10. Vocal band. 11. Trachea. 12. Œsophagus.

APPENDIX.

I.

NOTE ON ILLUMINATION.

THE instructions for the illumination of the laryngeal mirror given in the text only contemplate the projection by the reflector of an uniform disc of light, which, in the opinion of the author, is most convenient for ordinary laryngoscopic work. Such discs are formed in the vicinity of the image for a space of an inch or two before and after intersection of the rays, of suitable diameter, and without much variation in brilliancy. The actual image of the flame, though much more radiant, has the disadvantage of unequal brightness, being very brilliant at the edges, less so about the centre, and generally showing dark lines, whilst it is also of comparatively small calibre. Nevertheless, it is preferred by many continental laryngoscopists; and as by means of it a stronger light can be thrown on parts of the larynx, as well as because it is sometimes important to know its position, a short account of the methods of calculating its distance may be found useful by readers of this little work.

In the first place, it must be noted that when it is desired to illuminate the larynx by the image of the flame with the reflector worn on the face, the apparatus must be arranged so as to bring the pencil of light to a focus at about 12 inches from the concave mirror. By this reckoning it is considered that the eye of the observer is most conveniently placed at 6 inches from the patient's mouth, and the laryngeal mirror is 3 inches within the mouth, whence the light is reflected downwards another 3 inches to the vocal bands. From this position the light can be concentrated on any particular spot in the larynx by a slight movement of the observer's face in a suitable direction.

In order to determine the distance of the image of an object from a concave mirror, the following formula, of which the proof is contained in books on optics, is made use of:—

$$\frac{1}{DI} + \frac{1}{DO} = \frac{1}{F}.$$

In this equation, DI stands for the distance of the image, DO for that of the object, and F for the focal length of the mirror. Any two of the quantities being known, the third can be found. Investigation of various cases, by means of the formula, shows that (1) when the object (the naked flame as at present considered) is at a great distance, its image is at the principal focus;[1] (2) according as it moves nearer the image is thrown further off; (3) when it is at twice the focal length of the mirror the image is at the same distance; (4) when it arrives at the exact focal length no image is projected, but a system of parallel rays; and (5) that when it is at a less distance than that of the focus the rays are reflected in a divergent pencil, which merely produces a virtual image apparently behind the mirror.

With these facts before us, it becomes evident that reflectors of short focus are most convenient for lighting the larynx with the image of a naked flame. Thus the formula will inform us that in order to throw the image 12 inches—

With a mirror of	4	inches focus	the flame must	be placed	6	inches away.
,,	5	,,	,,	,,	8·5	,,
,,	6	,,	,,	,,	12	,,
,,	7	,,	,,	,,	16·8	,,
,,	10	,,	,,	,,	60	,,

The ordinary reflectors, therefore, of 10 or more inches focus require the flame at such a distance, as this statement shows, that a great part of the light is lost before reaching the mirror.

Another point in this subject that requires consideration is the size of the image formed by the reflector. This varies in different positions with regularity as expressed by the formula :—

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[1] That is, the focus for parallel rays such as come from a distant object like the sun. Its length is always half the radius of the sphere or circle of which the concave mirror presents a segment, and can therefore be determined geometrically, but it can also be found very easily by forming an image of the sun or any distant light on a sheet of white paper, and then measuring its distance from the reflector. Or the image of a flame a few inches from the mirror may be similarly formed, and the distances of both inserted in the above equation, whence the value of F will be at once apparent.

$$I : O :: DI : DO,$$

i.e., the image bears the same proportion to the object as its distance from the mirror bears to that of the object. Hence the image is smallest when at the principal focus, and increases in size as it passes away from that point, viz., as the flame approaches, whilst when the distance of both is the same their magnitude is also identical. As a rule, the brightness of the image varies inversely as its dimensions, but when the image is diminutive it is of course useless for illumination. The brilliancy varies also, however, according to the focal length and diameter of the mirror. Thus, with a reflector of short focus, when both flame and image are close to its surface, a large and bright image can be produced, whilst a large mirror will receive more rays than a small one and project them into the field of the image.

So far the naked flame only has been considered, but when it is desired to obtain from ordinary sources of artificial light an image both ample and of great radiance, a convex lens must intervene between the flame and the concave mirror. As the lens can stand very close to the flame, it will collect a proportionately greater number of the rays before their dispersion, and lessen their divergency so that they may all fall on the reflector. For the purpose a plano-convex lens is best, as by turning the flat side to the flame the loss of light through the reflection of the rays that impinge most obliquely is reduced to the minimum. The reflectors, however, best suited for the naked flame cannot generally be used with the lens, those of longer focus being demanded in the most advantageous arrangements.

There are three positions the lens may hold with respect to the flame, namely, (1) its exact focal length,[1] (2) less than this distance, and (3) greater than it. In all of these situations the pencil of light differs much as to the direction of its rays, and, therefore, when the highest effect is sought, requires corresponding modifications in the size of the lens and the focus of the reflector.

1. In the first case most of the light is refracted into a parallel pencil,

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[1] The principal focus of a lens can be determined experimentally in the same way as that of a concave mirror. If, however, the lens be a perfect sphere or hemisphere of glass, its focal length will be in the former case half the radius, and in the latter half its diameter.

and hence needs only a mirror of twelve inches focus, irrespective of the distance of the lamp, in order to bring the image on the larynx. Here the lens had better be about the same size as the reflector, so that the whole surface of the latter may be utilized in throwing the light. The simplicity of such an arrangement renders it so convenient that most laryngoscopists have given it the preference in practice over the others.

2. In the second position, as the virtual magnified image is formed by the lens on the same side as the flame, it is best to calculate the apparent distance of this image, using the same equation as has been given for concave mirrors, and then to treat it as regards the reflector precisely as if it were a real flame. Under these circumstances one of the reflectors of short focus must be chosen; and, as the pencil of light is divergent, a lens considerably smaller should be employed, lest a quantity of the rays be lost by being projected beyond the circumference of the mirror. On the whole, this disposition of the lens is the least profitable, and not being particularly facile may be dismissed from serious consideration.

3. The third situation of the lens is that from which the finest results may be obtained, as the light may be collected by a large lens of five or six inches diameter or even more, and refracted into a convergent pencil, of such calibre as to be entirely comprised by the reflector, but it also requires that the reflector should be adapted to the state of the projected rays both with respect to focus and position with considerable precision. A variety of reflecting mirrors may, in fact, be used effectively, according to the distance to which the image is thrown by the lens. Thus, if the image is formed a few inches from the lens it may be acted on by a reflector of short focus, as if it were a real flame; or if two feet or more away, the rays can be intercepted and passed to intersection on the larynx by a concave mirror of long focus (not less than 14 or 15 inches); or lastly, if at 18 or 24 inches, the pencil may be received 6 or 12 inches from the lens by a plane reflector, and turned unaltered in the proper direction. In all these instances the size of the image produced by the lens must be taken into consideration and calculated similarly as when dealing with a concave mirror. The best positions can easily be determined experimentally, and the greatest exactitude can be ensured by employing reflectors fixed to a stand, so that, when once placed, they need not be disturbed as when attached to the observer's face.

When illuminating the laryngeal mirror directly from the lens, the distance of the image can be found exactly as in the case of a concave mirror and naked flame.[1] At the outset of laryngoscopy Türck employed in this way a glass globe about 6 inches in diameter, filled with water, a device which is still, I believe, used by Walker and Störk. The focus of such a sphere, if of solid glass, would be 1½ inch (half the radius) from its surface, but owing to the lesser refractive power of water it is removed to about 3½ inches. In order, therefore, to obtain the image at 12 inches, the flame must be placed 5 inches behind the globe. The single advantage, however, of such a globe over a plano-convex glass lens is its cheapness, for, as regards the light, it is a most wasteful contrivance; many rays are lost by reflection from the spherical surface turned to the flame, and many more by absorption in their transit through so thick a stratum of water. These difficulties might be obviated to a great extent by substituting a hemisphere of glass filled with water, but its diameter would have to be reduced in order to preserve a convenient focal length.

Some laryngoscopists, amongst whom is Tobold, place two or three lenses before the flame, the effect being, of course, that the focus is shortened in proportion to the power of each additional lens without the size of that next the flame being lessened. But the loss of light at the various surfaces and by absorption is very likely to neutralize the corresponding gains. A second lens can not be required unless the first is a hemisphere,[2] nor a third, unless the second is also a hemisphere, whence it may be deduced that a third lens can scarcely ever be added with benefit. In the combinations I have seen, however, this rule has been disregarded, and lenses of slight curvature used, so that the same focus could have been obtained and a superior light by a single lens of the highest curvation. In these cases, therefore, the belief in the advantage of the arrangement can only have arisen fallaciously from the known value of combinations of lenses in augmenting magnifying power, and at the same time giving clear definition by counter-balancing the different kinds of aberration.

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[1] A parallel pencil may, of course, be used direct from the lens, but I think it the least advantageous, as it neither produces an uniform circle nor a brilliant image. It gives, in fact, at every distance an imperfect image, showing the outline of the flame and exaggerating disagreeably its dark shades. When the ordinary reflectors of long focus are used with the naked flame in the usual position, it is very likely to be about the focal length from the mirror. Hence I advise the light to be shifted considerably back or forward.

[2] Or, to speak with the greatest exactitude, unless the joint effect of the two considerably exceeds that of a single hemisphere of the same diameter.

Although most of the matters discussed in this note may be neglected in ordinary laryngoscopy without much sensible disadvantage, when it is necessary to examine the whole course of the windpipe, a little consideration must be given to optical principles, inattention to which has caused some observers to declare that the bifurcation of the trachea could only be viewed by the aid of an unusually strong light, after great practice, etc. As the trachea is about 4½ or 5 inches long, this distance must be added to the 12 inches already fixed on as a suitable trajection of the light when illuminating the larynx. For, notwithstanding that the vicinity of the vocal bands may be well lighted, the dispersion of the rays is usually such that few, if any, of them fall as far down as the origin of the bronchi. This part cannot be lighted, therefore, unless the image be thrown to about 17 inches, or parallel rays from a brilliant flame be employed. But it is also essential that the line of vision, the axis of the pencil of light and that of the trachea should exactly, or very nearly, coincide. Hence in this case it is absolutely necessary to look through the hole in the reflector, whilst direct light cannot be employed with so much success. When the axis of the trachea cannot be made to correspond with that of vision and light by manipulating the laryngeal mirror, it is advisable, as Türck has pointed out, to try and alter the course of the tube by pressing it one way or another with the thumb and forefinger applied to it outside on the neck. Proceeding on optical principles it will found that in suitable instances almost as good a view can be procured of the bifurcation of the trachea even with a candle flame as can generally be obtained of the larynx with the same light.

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ON THE RHINOSCOPE.

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1862. **Semeleder**, F., Leipzig.—*Die Rhinoskopie und ihr Werth für die ärtzliche Praxis.*
1869. **Thudichum**, J. L. W., London.—In *On Polypus in the Nose and Ozœna,* etc.
1870. **Durham**, A., London.—In Holmes' *System of Surgery,* vol. iv.
1876. **Fränkel**, P.—In Ziemssen's *Cyclopædia of the Practice of Medicine,* vol. iv.
„ **Krishaber**, M., Paris.—Article *Rhinoscopie,* in *Dictionnaire des sciences médicales.*
1879. **Voltolini**, R., Breslau.—*Die Rhinoskopie und Pharyngoscopie für Specialisten, Chirurgen, und Praktische Aerzte.*

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